CLAIMS

1. A catalyst for the selective hydrogenation of acetylene, comprising:

a support selected from the group consisting of alumina, titania, zirconia, zinc aluminate, zinc titanate and mixtures thereof, wherein the support has a uniformly round external surface, a surface area in the range of about 3 to about 10 square meters per gram, and a pore volume of about 0.24 to about 0.64 cubic centimeters per gram;

palladium in the range of about 0.01 to 1.0 weight percent of the catalyst, wherein substantially all of the palladium is concentrated in a skin periphery of the catalyst, wherein the skin has a thickness less than about 400 microns; and

silver in the range of about 0.5 to 10.0 times the weight of the palladium, wherein the silver is distributed throughout the catalyst.

2. A catalyst according to claim 1, wherein the external surface of the support is rounded to an extent such that the skin thickness is substantially uniform throughout the external surface.

3. A catalyst according to claim 1, wherein the support of the catalyst is non-spherical yet uniformly round.

4. A catalyst according to claim 3, wherein non-spherical support is oval-shaped, egg-shaped, or soccer-ball-shaped.

5. A catalyst according to claim 1, wherein the support of the catalyst is spherical and has an average pore diameter from about 600 Angstroms to about 5000 Angstroms.

6. A catalyst according to claim 1, further comprising:

an alkali metal present in the range of about 0.01 to 10 weight % of the catalyst.

7. A catalyst according to claim 6, further comprising:

a halide in the range of about 0.1 to 10 times the molar concentration of alkali metal present in the catalyst.

8. A catalyst according to claim 7, wherein the alkali metal comprises potassium.

9. A catalyst according to claim 1, wherein the dimensions of the catalyst particles are in the range of about 2 to about 8 millimeters.

10. A catalyst according to claim 9, wherein the weight ratio of silver to palladium is no greater than about 10.

11. A catalyst according to claim 9, wherein the weight ratio of silver to palladium is in the range of about 0.5 to about 8.

12. A catalyst according to claim 11, containing about 0.01 to 0.5 weight percent palladium.

13. A catalyst according to claim 1, wherein the catalyst is prepared by impregnating alumina particles with a solution of palladium chloride or palladium nitrate.

14. A catalyst according to claim 13, wherein the catalyst is prepared by mixing the catalyst particles with an aqueous solution of silver nitrate.

15. A catalyst according to claim 1, wherein a selectivity of the catalyst for the conversion of acetylene to ethylene is greater than 40 %.

16. A catalyst according to claim 15, wherein the palladium is less than 0.05 weight % of the catalyst.

17. A catalyst according to claim 7, wherein a selectivity of the catalyst for the conversion of acetylene to ethylene is greater than 50 %.

18. A catalyst according to claim 17, wherein the palladium is less than 0.03 weight % of the catalyst.

19. A method for the treatment of a gaseous mixture comprising acetylene, which method comprises selectively hydrogenating the acetylene therein by contacting the mixture together with hydrogen with a catalyst;

wherein the catalyst comprises a support selected from the group consisting of alumina, titania, zirconia, zinc aluminate, zinc titanate, and mixtures thereof, wherein the support has a uniformly round external surface, a surface area in the range of about 3 to about 10 square meters per gram, and a pore volume of about 0.24 to about 0.64 cubic centimeters per gram;

wherein the catalyst comprises palladium in the range of about 0.01 to 1.0 weight percent of the catalyst, wherein substantially all of the palladium is concentrated in a skin periphery of the catalyst, wherein the skin has a thickness less than about 400 microns; and

wherein the catalyst comprises silver in the range of about 0.5 to 10.0 times the weight of the palladium, wherein the silver is distributed throughout the catalyst.

20. A method according to claim 19, wherein the external surface of the support is rounded to an extent such that the skin thickness is substantially uniform throughout the external surface.

21. A method according to claim 19, wherein the support of the catalyst is non-spherical yet uniformly round.

22. A method according to claim 21, wherein the non-spherical support is oval-shaped, egg-shaped, or soccer-ball-shaped.

23. A method according to claim 19, wherein the external surface of the support is spherical and has an average pore diameter from about 600 Angstroms to about 5000 Angstroms.

24. A method according to claim 19, wherein the catalyst further comprises an alkali metal present in the range of about 0.01 to 10 weight % of the catalyst.

25. A method according to claim 24, wherein the catalyst further comprises a halide in the range of about 0.1 to 10 times the molar concentration of alkali metal present in the catalyst.

26. A method according to claim 25, wherein the alkali metal comprises potassium.

27. A method according to claim 19, wherein the gaseous mixture contains less than about 1000 ppm of carbon monoxide.

28. A process according to claim 27, wherein the weight ratio of silver to palladium in the catalyst is no greater than about 10.

29. A method according to claim 28, wherein the dimensions of the catalyst particles are in the range of about 2 to about 8 milliliters.

30. A method according to claim 29, wherein the weight ratio of silver to palladium is in the range of about 0.5 to about 8.

31. A method according to claim 30, wherein the hydrogenation temperature is in the range of about 35 °C. to about 150 °C. and the space velocity is in the range of about 1,000 hr^{-1} to about 20,000 hr^{-1}.

32. A method according to claim 31, wherein the gaseous mixture contains no more than about 800 ppm of carbon monoxide.

33. A method according to claim 32, wherein the catalyst is prepared by impregnating alumina particles with a solution of palladium chloride, calcining the impregnated alumina particles, and mixing the particles with an amount of an aqueous solution of silver nitrate in excess of the pore volume of the alumina.

34. A process according to claim 33, wherein the catalyst contains about 0.01 to 10 weight % palladium.

35. A process according to claim 19, wherein the catalyst is housed in a vessel, further comprising:

flowing the acetylene through the vessel to contact the catalyst;

flowing a heat transfer fluid across an exterior surface of the vessel to remove heat from the vessel; and

modulating the flow of heat transfer fluid to maintain a temperature of the heat transfer fluid within a predetermined range.

36. A process according to claim 35, wherein the predetermined range is about 30 °C. to about 150 °C.

37. A method according to claim 19, wherein a selectivity of the catalyst for the conversion of acetylene to ethylene is greater than 40 %.

38. A method of claim 37, wherein the palladium is less than 0.05 weight % of the catalyst.

39. A method according to claim 25, wherein a selectivity of the catalyst for the conversion of acetylene to ethylene is greater than 50 %.

40. A method of claim 39, wherein the palladium is less than 0.03 weight % of the catalyst.

41. A catalyst for the selective hydrogenation of acetylene, comprising:

an alpha alumina support, wherein the support has a uniformly round external surface, a surface area in the range of about 3 to about 10 square meters per gram, a

pore diameter of about 600 Angstroms to about 5000 Angstroms, and a pore volume of about 0.24 to about 0.64 cubic centimeters per gram;

palladium in the range of about 0.01 to 1.0 weight percent of the catalyst, wherein substantially all of the palladium is concentrated in a skin periphery of the catalyst, wherein the skin has a thickness less than about 400 microns;

silver in the range of about 0.5 to 10.0 times the weight of the palladium, wherein the silver is distributed throughout the catalyst;

potassium present in the range of about 0.01 to 10 weight % of the catalyst; and

fluoride in the range of about 0.1 to 10 times the molar concentration of potassium present in the catalyst.

42. A catalyst according to claim 41, wherein a selectivity of the catalyst for the conversion of acetylene to ethylene is greater than 50 %.

43. A catalyst according to claim 42, wherein the palladium is less than 0.05 weight % of the catalyst.